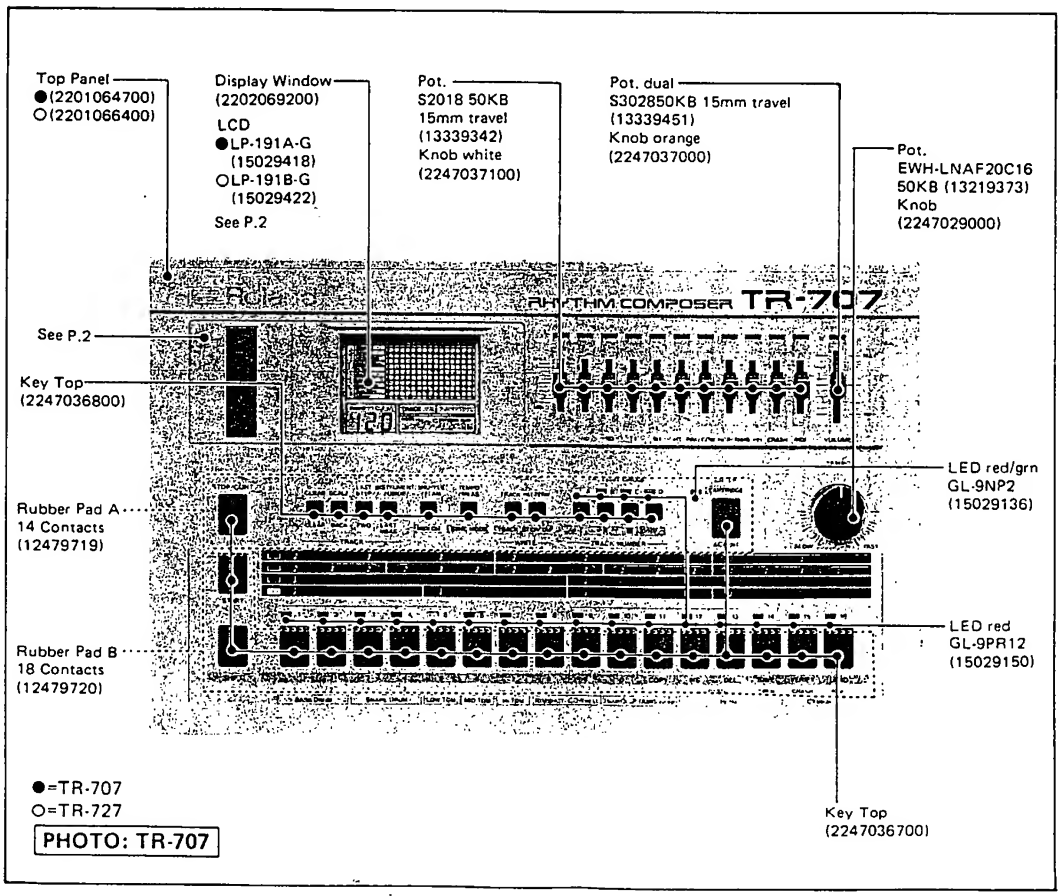
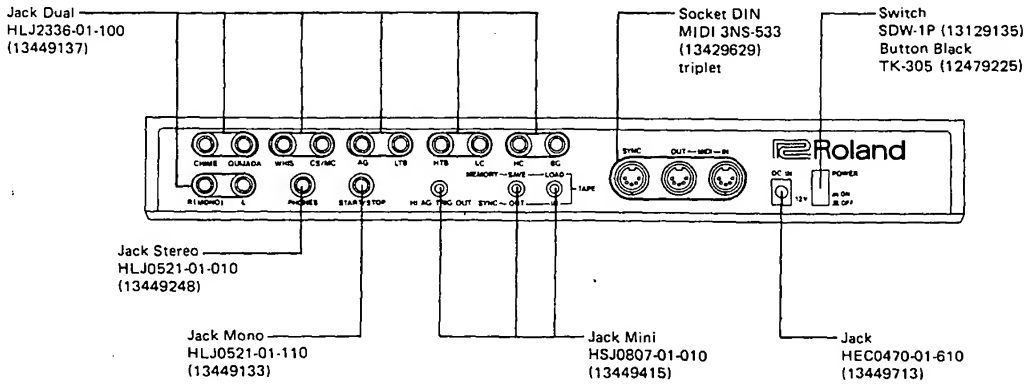
TR-707/727 SERVICE NOTES

First Edition

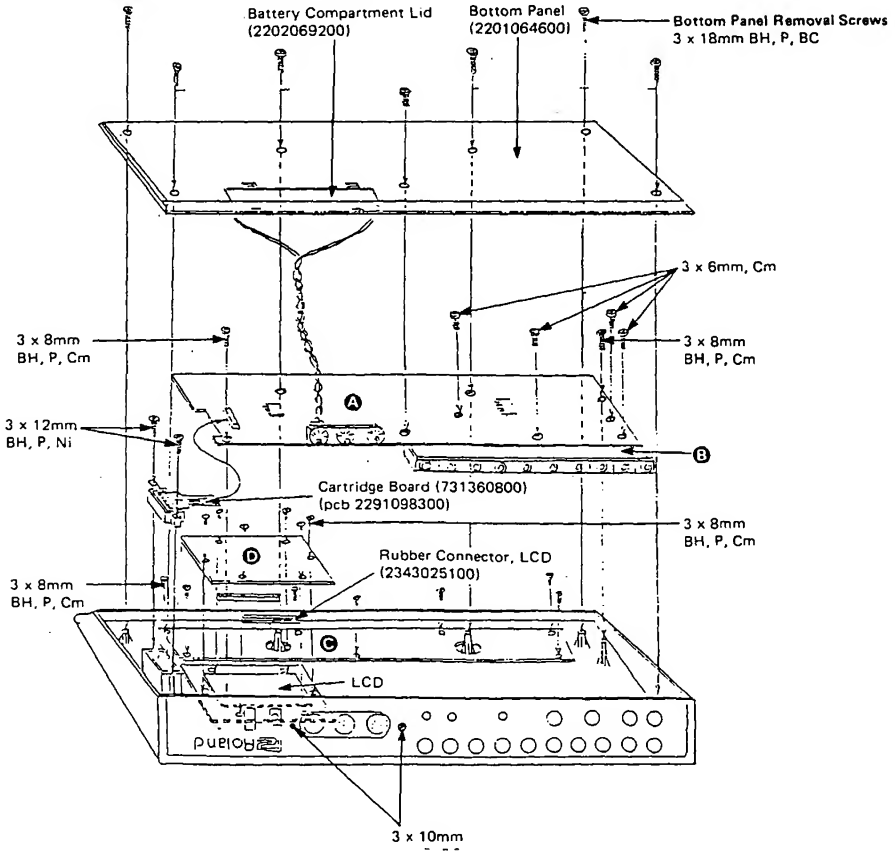
SPECIFICATIONS

Memory Capacity	:	64 Rhythm Patterns (16 x 4 Group)
Track	:	4 (1 to 4; continuous Maximum measures=998)
Step	:	1 to 16 steps/measure
Tempo	:	♩ = 38 to 250
Rear Panel	:	Master Out (L,R/MONO) [8Vp-p, 1KΩ]
Trigger Out	:	+5V, 20ms Pulse TR-707 . . . . . Rim Shot TR-727 . . . . . Hi Agogo
Sync In/Out (5P DIN)	:	(1: Run/Stop, 2: GND, 3: Clock, 4: NC, 5: Continue)
Power Consumption	:	2.4 W
Dimensions	:	380 (W) x 73 (H) x 250 (D) mm 14-15/16" (W) x 2-7/8" (H) x 9-13/16" (D) in
Weight	:	1.5 kg/13 lb. 5 oz.
Accessories	:	12V AC Adaptor Connection Cord PJ-1
Options	:	Memory Cartridge M-64C Pedal Switch DP-2

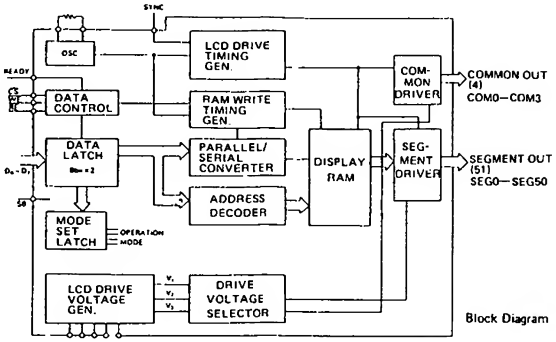




	TR-707	TR-727
Ⓐ	Voicing Board (7313604000) (pcb 2291098102)	Voicing Board (7313804000) (pcb 2292018900)
Ⓑ	Volume Board (7313605000) (pcb 2291098002)	Volume Board (7313805000) (pcb 2292019000)
Ⓒ	Switch Board (7313606000) (pcb 2291097903)	
Ⓓ	LCD Board (7313607000) (pcb 2291098203)	

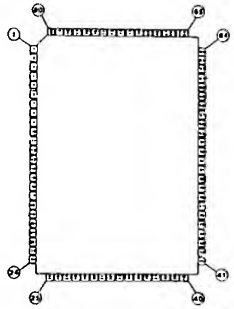


LCD Driver
HD61602



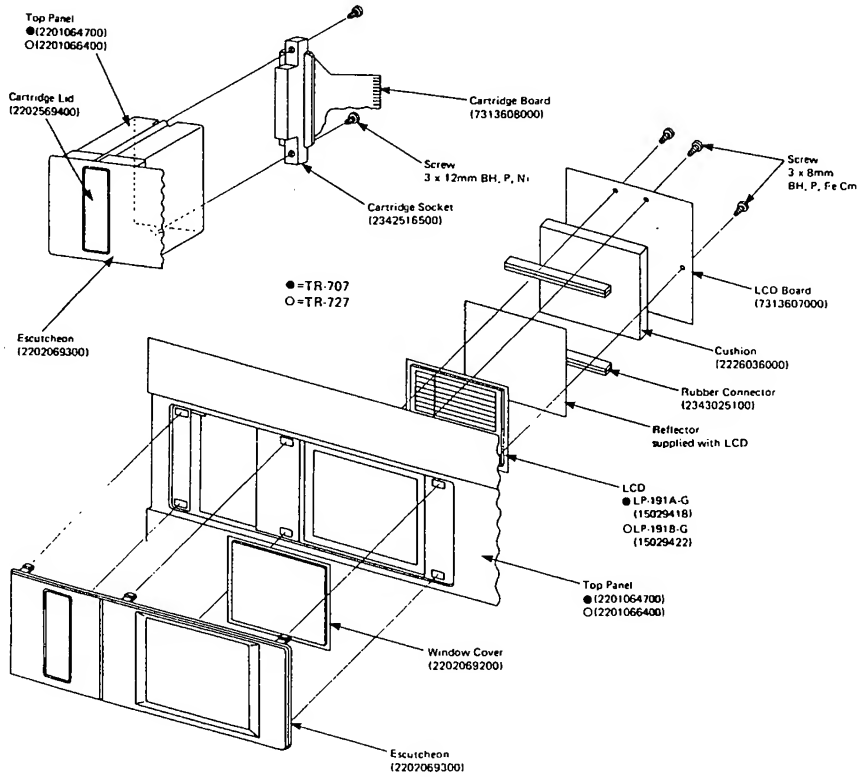
Block Diagram

Pin configuration
(Top View)



TERMINAL ASSIGNMENTS

Pin no.	Pin name	Pin no.	Pin name	Pin no.	Pin name
1	Vdd	28	SEG49	55	SEG22
2	RLADY	29	SEG48	56	SEG21
3	$\overline{CS}$	30	SEG47	57	SEG20
4	$\overline{RE}$	31	SEG46	58	SEG19
5	$\overline{WE}$	32	SEG45	59	SEG18
6	SB	33	SEG44	60	SEG17
7	D7	34	SEG43	61	SEG16
8	D6	35	SEG42	62	SEG15
9	D5	36	SEG41	63	SEG14
10	D4	37	SEG40	64	SEG13
11	Vss	38	SEG39	65	SEG12
12	D3	39	SEG38	66	SEG11
13	D2	40	SEG37	67	SEG10
14	D1	41	SEG36	68	SEG9
15	D0	42	SEG35	69	SEG8
16	Vref1	43	SEG34	70	SEG7
17	Vref2	44	SEG33	71	SEG6
18	VC2	45	SEG32	72	SEG5
19	VC1	46	SEG31	73	SEG4
20	V1	47	SEG30	74	SEG3
21	V2	48	SEG29	75	SEG2
22	V3	49	SEG28	76	SEG1
23	COM0	50	SEG27	77	SEG0
24	COM1	51	SEG26	78	SYNC
25	COM2	52	SEG25	79	OSC2
26	COM3	53	SEG24	80	OSC1
27	SEG50	54	SEG23	——	——



PARTS LIST
EXCLUSIVE PARTS

TR-707

CASING

2201064700	Top Panel	

PCB

7313604000	Voicing Board	(pcb 2291098102)
7313605000	Volume Board	(pcb 2291098002)

LCD

15029418	LCD	LP-191A-G

IC

Program ROM		
15179720	HN4827128G-25	NMOS EPROM (Ver.0 SN460100-504399) (Ver.1 SN504400-519599)
or		
15179660	HN613128PE95	CMOS MASK ROM (Ver.1 SN519600-533099)
or		
15179692	HN613128PG24	CMOS MASK ROM (Ver.2 SN533100-up)

UPWARD COMPATIBILITY
Ver.0
In Pattern PLAY mode -- Selecting a pattern from different scale while repeating STOP and START or CONTINUE sometimes leads to Power-ON initialization.
ROMs of Ver. 1 always run the new pattern at the beginning of a measure.

Ver.1
When the unit is used as a Master -- Repetitions of STOP and CONTINUE more than 30 times would cause generation of a redundant MIDI clock $F8.
When the unit is used as a Slave -- Will miss a MIDI IN clock when STOP signal follows the Clock within 1ms.

MASK ROM of Ver.2 cures this problem.
For a replacement Ver.2 or up is recommendable.
上位コンパチなので補修用としてはバージョン番号の大きいPROMの使用が望ましい。

Sound ROM		
15179661	HN61256PC-71	CMOS MASK ROM BD1/2, SD1/2, LT, MT
15179662	HN61256PC-72	CMOS MASK ROM HT, Open/Closed H.H, Rim, Cow HCP, Tambourine
15179663	HN61256PC-73	CMOS MASK ROM Crash Cymbal
15179664	HN61256PC-74	CMOS MASK ROM Ride Cymbal

TR-727

CASING

2201066400	Top Panel	

PCB

7313804000	Voicing Board	(pcb 2292018900)
7313805000	Volume Board	(pcb 2292019000)

LCD

15029422	LCD	LP-191B-G

IC

Program ROM		
15179719	HN4827128G-25	NMOS EPROM
Sound ROM		
15179694	HN61256PC-79	CMOS mask ROM HI/LOW BONGO, HI CONGA LOW CONGA, HI TIMBALE

15179695	HN61256PC-80	CMOS mask ROM LOW TIMBALE, AGOGO, CABASA MARACAS, WHISTLE
15179696	HN61256PC-81	CMOS mask ROM CUICA
15179697	HN61256PC-82	CMOS mask ROM STAR CHIME

COMMON PARTS

CASING

2201064600	Bottom Case	
2202069100	Battery Cover	
2202069200	Display Window	
2202069300	LCD Escutcheon	
2202569400	Cartridge Lid	

KNOB, BUTTON, KEY TOP

2247029000	Knob	gray	TEMPO
2247036700	Key Top (large)	gray	Main Key 1-16,ENTER, START,SHIFT,STOP/CONT
2247036800	Key Top (small)	gray	
2247037100	Knob	white	BD,SD,LT,MT,HT,OCH, RS/CB,HCP/TAMB,RIDE, CRASH
2247037000	Knob	orange	VOLUME
12479225	TK-305	black	POWER

PCB ASSY

7313606000	Switch Board	(pcb 2291097903)
7313607000	LCD Board	(pcb 2291098203)
7313608000	Cartridge Board	(pcb 2291098300)

COIL, TRANSFORMER

2244025000	S097744	Transformer	DC/DC convertor
12449229	FK0B160MH15	Coil	line filter

SOCKET

13429629	MIDI 3-MS-533	DIN
13449713	HEC0470-01-610	AC adapter
13449415	HSJ0807-01-010	mini
13449248	HLJ0521-01-010	stereo
13449133	HLJ0521-01-110	monoral
13449137	HLJ2336-01-100	dual
2342516500	PBRS-28U-T01-S	cartridge

SWITCH

12479719	Rubber switch (Pad) A	14 contact upper row
12479720	Rubber switch (Pad) B	18 contact lower row
13129135	SDW-1P	POWER

POTENTIOMETER

13339342	S2018 50KB	slide 15mm travel
13339451	S3028 50KB	dual slide 15mm travel
13219373	EWH-LNAF20C16 50KB	TEMPO
13299136	RVF8P01-503 50KB	trimmer
13299141	RVF8P01-204 200KB	trimmer

XTAL, CERAMIC RESONATOR

12389736	HC-18/U	4.0MHz Xtal
12389735	CSA 1.6MX	1.6MHZ ceramic resonator

IC

15229825	RD63H114PF	gate arrey
15179200	HD6303XF	CPU
15179340	HM6116LP-4	CMOS S RAM
15219148	HD61602	LCD driver
15159503	TC40H000P quad 2-input NAND gate	H CMOS
15159504	TC40H002P quad 2-input NOR gate	H CMOS
15159505	TC40H004P hex inverter	H CMOS
15159517	TC40H010P triple 3-input NAND gate	H CMOS
15159506	TC40H138P 3-to-8 line decoder/demutltiplexer	H CMOS
15159535	TC40H151P 1-of-8 data selector/multiplexer	H CMOS
15159511	TC40H174P hex D-type flip flop	H CMOS
15159524	TC40H245P octal bidirectional bus buffer	H CMOS
15159507	TC40H273P octal D-type flip flop	H CMOS
15159530	TC40H367P hex bus buffer	H CMOS
15159104	TC4011BP quad 2-input NAND gate	CMOS
15159105	TC4013BP dual D-type flip flop	CMOS
15159141	HD14040BP 12-stage binary counter	CMOS
15159113	HD14051BP single 8-channel multiplexer/demultiplexer	CMOS
15159301	TC4520BP dual binary up counter	CMOS
15159303	HD4584BP hex schmitt trigger	CMOS
15189136	M5218L	Op amp
15189154	TL064	FET Op amp
15219147	UPC624C	D/A convertor
15199108F0	UA78M05UC	voltage regurator +5V
15229712	PC900	photo coupler
15149118	M54517P	transistor array

TRANSISTOR

15129612	2SD1469-R	NPN
15129137	2SC2603-F	NPN
15129412	2SC1384-Q	NPN
15119125	2SA1115-F	PNP
15139101	2SK30ATM-Y	FET

DIODE

15019126	1SS113T-77	diode
15019209T0	S-5500G	rectifier
15019667	RD-12EB1-T	12V zener
15029136	GL-9NP2	LED red/grn
15029150	GL-9PR12	LED red

RESISTOR ARRAY

13919133	RKM7LM502		D/A converter
13919103	RGSD8X103J	10K x 8	
13919113	RGSD4X103J	10K x 4	
13910107	RSD8X332J	3.3K x 8	

CONNECTOR

13439256	5089-11A	11P (Switch pcb)	
13439255	5089-13A	13P (Switch pcb)	
13439253	5494-9C	9P (Voicing pcb)	
13439252	5494-10C	10P (Voicing pcb)	
13439254	5597-28APB	28P (Voicing pcb)	cartridge
2343025100			rubber connector LCD

WIRING ASS'Y

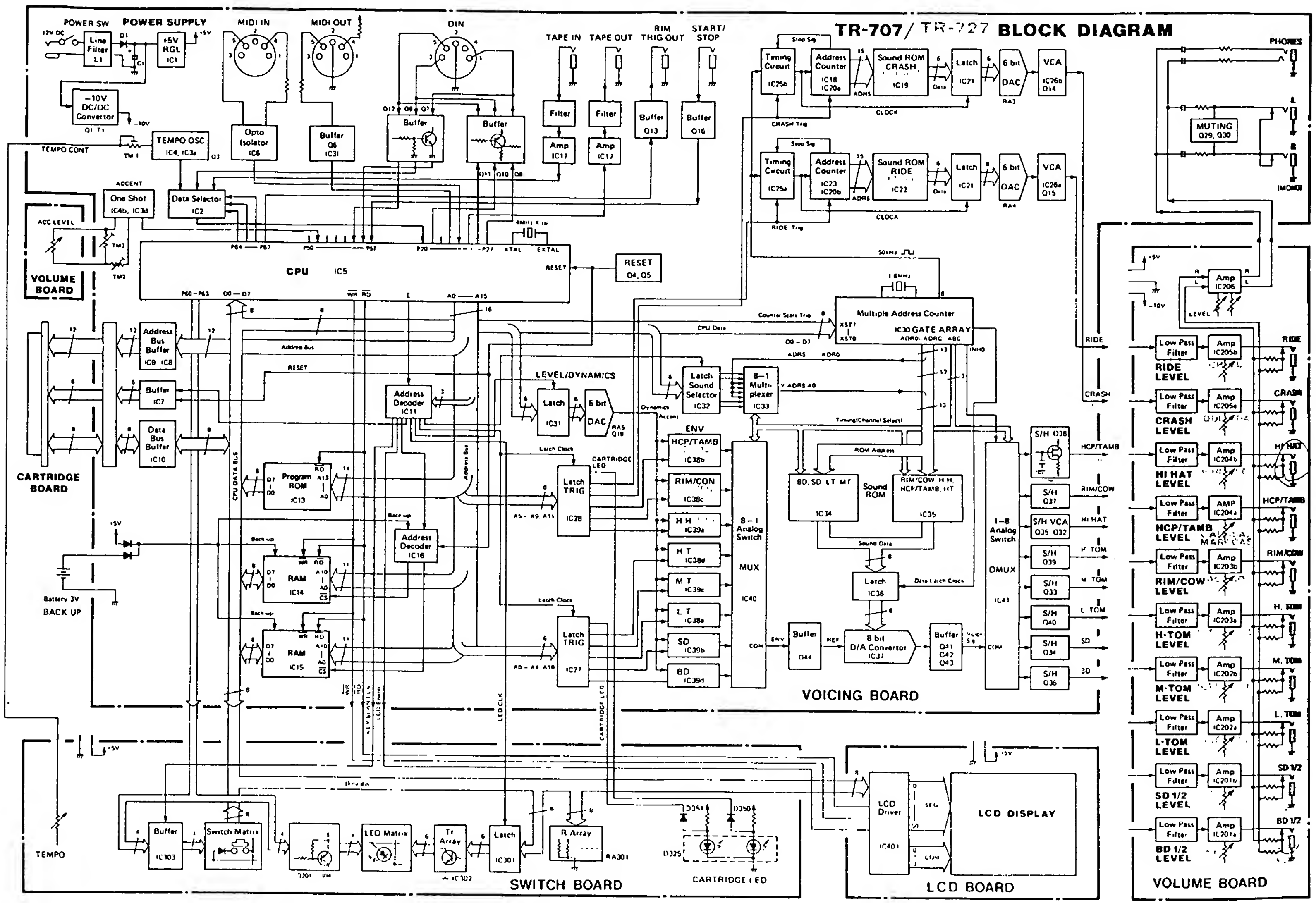
2341048000	13P	(LCD pcb)
2341047900	11P	(Voicing pcb)
2347015200	9P flat cable	(Volume pcb)
2347015300	10P flat cable	(Volume pcb)

MISCELLANEOUS

2217515300	Spring		RAM cartridge
2214531300	Shaft		RAM cartridge
2345014600	Plate		battery
12469117	Heat Sink MT-25-BS		
2219049900	LED Holder		(switch pcb)
13529117	Ceramic Capacitor	D55Y5V1H334Z21 0.33μF	(LCD pcb)
12559708	Fusing Resistor	FRNB 1/4W2.7Ω	
2225022801	Shield Cover		top panel
2225022400	Shield		(Voicing pcb-Volume pcb)

COMMERCIALLY AVAILABLE ACCESSORIES

12569105	Dry cell SUM-3S 1.5V	
12449538	12V AC adapter (100V)	
12449539	12V AC adapter (117V)	
12449540	12V AC adapter (220V)	
12449541	12V AC adapter (240VA)	Australian
2343067500	Connection Cable LP-25	


TR-707/ TR-727 BLOCK DIAGRAM
POWER SW
POWER SUPPLY
Line Filter L1
+5V RGL IC1
-10V DC/DC Convertor
TEMPO OSC IC4, IC3a
TEMPO CONT
One Shot IC4b, IC3d
ACCENT
ACC LEVEL
VOLUME BOARD
Data Selector IC2
MIDI IN
MIDI OUT
Opto Isolator IC6
Buffer Q6 IC31
DIN
Buffer
TAPE IN
TAPE OUT
RIM TRIG OUT
START/ STOP
Filter
Amp IC17
Buffer Q13
Buffer Q16
CPU IC5
RESET Q4, Q5
CARTRIDGE BOARD
Address Bus Buffer IC9 IC8
Buffer IC7
Data Bus Buffer IC10
Program ROM IC13
RAM IC14
RAM IC15
Address Decoder IC11
Address Decoder IC16
Battery 3V
BACK UP
CPU DATA BUS
Address Bus
RESET
LEVEL/DYNAMICS
Latch IC31
6 bit DAC
Latch TRIG IC28
Latch TRIG IC27
Latch Sound Selector IC32
8-1 Multi-plexer IC33
Timing Circuit IC25b
Address Counter IC18 IC20a
Sound ROM CRASH IC19
Latch IC21
6 bit DAC
VCA IC26b Q14
Timing Circuit IC25a
Address Counter IC23 IC20b
Sound ROM RIDE IC22
VCA IC26a Q15
CLOCK
CRASH Trig
RIDE Trig
Multiple Address Counter
IC30 GATE ARRAY
ENV
HCP/TAMB IC38b
RIM/CON IC38c
H H IC39a
H T IC38d
M T IC39c
L T IC38a
SD IC39b
BD IC39d
8-1 Analog Switch
MUX IC40
BD, SD LT MT IC34
Sound ROM
RIM/COW H H, HCP/TAMB, HT IC35
Latch IC36
8 bit D/A Convertor IC37
Buffer Q44
Buffer Q41 Q42 Q43
1-8 Analog Switch
DMUX IC41
S/H Q38
S/H Q37
S/H VCA Q35 Q32
S/H Q39
S/H Q33
S/H Q40
S/H Q34
S/H Q36
VOICING BOARD
MUTING Q29, Q30
PHONES
L
R
(MONO)
Amp IC206
LEVEL
Low Pass Filter
Amp
RIDE LEVEL
CRASH LEVEL
HI HAT LEVEL
HCP/TAMB LEVEL
RIM/COW LEVEL
H-TOM LEVEL
M-TOM LEVEL
L-TOM LEVEL
SD 1/2 LEVEL
BD 1/2 LEVEL
RIDE
CRASH
HI HAT
HCP/TAMB
RIM/COW
H. TOM
M. TOM
L. TOM
SD 1/2
BD 1/2
VOLUME BOARD
TEMPO
Buffer IC303
Switch Matrix
LED Matrix
Tr Array IC302
Latch IC301
R Array
RA301
SWITCH BOARD
CARTRIDGE LED
LCD Driver IC401
LCD DISPLAY
LCD BOARD

CIRCUIT DESCRIPTIONS

TR-707 and TR-727 are designed based on the same circuit configuration, having more in common with each other. The differences between two models are sound data, component values in several audio stages and a couple of pin connections at IC30 of Voice board.

Both models derive all rhythm sounds from PCM-encoded samples of real sounds stored in ROM. Each waveform is stored either independently (e.g. CYMBAL) or together with another waveform as shown in Tables 1 and 2. Accordingly, sound reproducing circuits are classified into two: multiplex and single. The following description focuses on PCM sound reproduction system, taking TR-707 circuits as a representative.

回路解説

TR-707/727はROMにメモリされているPCM成形（サウンドデータ）を音源として利用しています。楽器の種類が異なる為一部に結線や定数の違いがあるものの、全体の回路構成は両機種に共通です。以下TR-707を例にとって説明します。

表1及び2から判る様に、IC34、IC35には複数音源のデータが、IC19、IC22には単一音源がメモリされています。従って、これら音源データの読み出しから再生までの過程もシングル方式とマルチの二種類があります。

MULTIPLEX SOUND PROCESSING

MULTIPLE ADDRESS COUNTERS

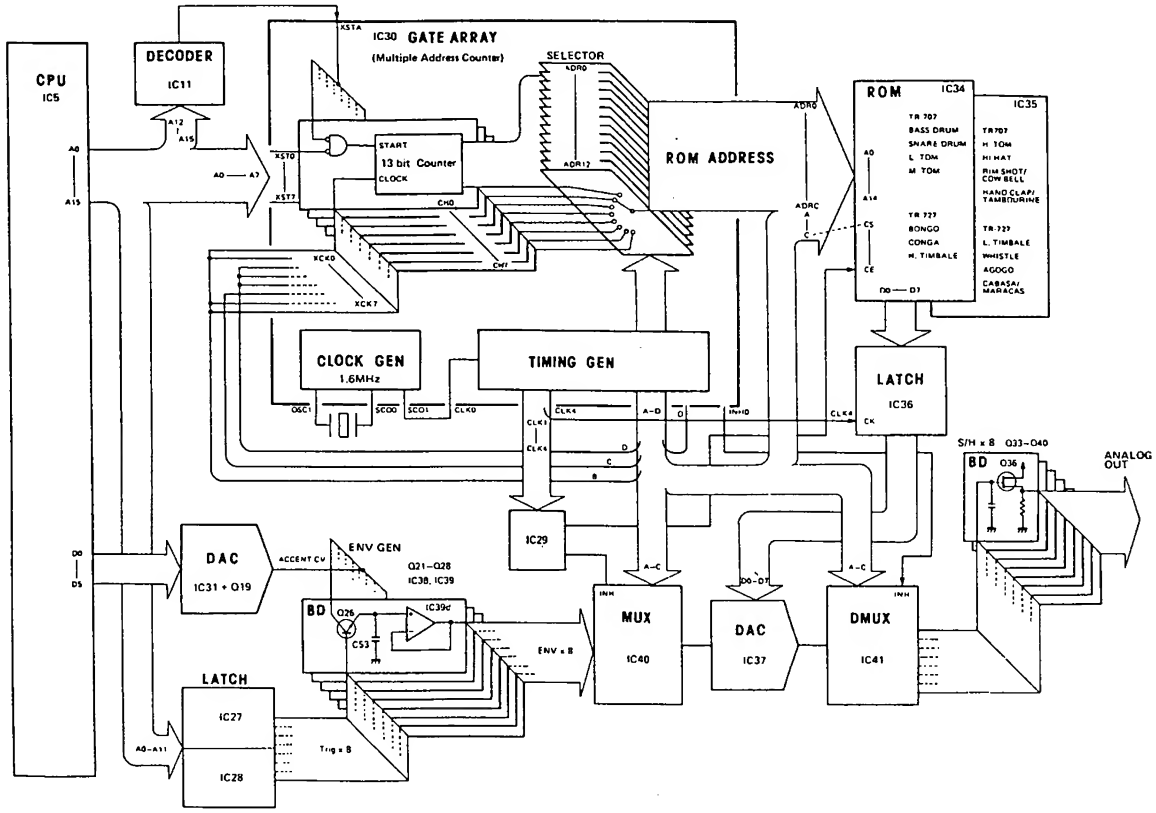
IC30 RD63H114 on Voicing Board is a custom-LSI(called Gate Array) designed for use in PCM-sound multi-rhythm systems. The LSI assumes the key role in the TR-707 sound system. It incorporates a master clock generator, timing generator and 8 13-bit address counters. The timing generator, not only supplies clocks to these counters for generating address bits, but also feeds peripheral circuits with various timing clocks to sync the entire system operation. Of these timing clocks, A, B and C together make a channel-select code for signaling the ROMs (ICs 34, 35), MUX IC40 and DMUX IC41 which voice is being addressed by an address counter in IC30.

マルチ音源

マルチプル・アドレスカウンタ

多音源データをメモリしているROM（IC34，35）からのデータ読み出し、D/A変換、S/Hおよびその他の関連回路は、IC30 RD63H114をマスターとして動作します。RD63H114はマルチ音源複器用に開発されたカスタムLSIであって、内蔵のクロックおよびタイミング発生回路によりこれら外付回路を同期させるクロック信号を出力します。同期クロックのうちA，B，Cはボイス・チャンネルのセレクトコードを形成しますので特に重要です。IC30はROM（IC34，35）内の各音源データのアドレスを次々と出力して行きますが、A，B，Cは今どの音源アドレス（アドレス・カウンタのチャンネル番号）が出力されているかを、ROM以外のMUX IC40，DMUX IC41にも知らせます。（例SDの場合 A＝1，B＝0，C＝0。次頁のタイミングチャート参照）

MULTIPLEX SOUND SYSTEM BLOCK DIAGRAM



Now suppose that TR-707 is to run with BASS DRUM 1(BD-1) being selected, the CPU IC5 puts XST0 (CH0 start) and XSTA (XST0–XST7 enable) low, resetting counter 0, presetting it to the starting address 0000H and allowing it to count the clock pulse XCK0 from pin B in discrete steps. The counter continues counting until it increments up to 1FFFH and tops there until the next trigger pulse is received. While counting, the contents (a group of 13 clock pulses) of the counter is transferred to address selector where it is read every 40μs and is presented along ports ADR0 through ADRC--13 lower address bits.

PCM MEMORY READING

IC34 and IC35, 32,768 word by 8 bit ROM, require 15 address bits to access their memory locations. Clocks A and B from IC30 serve as MSBs while C indicates which one of two ROMs is to be selected--Chip Select.

On the contrary, LSB ADR0 is defeated when particular voice is selected: BD-1 and BD-2 share the same memory area with even addresses allocated to BD-1 and odd ones to BD-2 as shown in Table 1. With BD-1, data selector IC33 blocks ADR0 and passes "0" data from IC32 onto A0 of ROM IC35. With BD-2, IC33 selects "1". With Low Tom, Mid Tom, Hi Tom or Hi Hat, ADR0 is allowed to reach A0.

Each 8-bit memory location (PCM waveform data) in ROM is loaded into latch IC36 on the rising edge of CLK4. This 8 bit data is, if converted to analog equivalent by D/A converter IC37 as it is, not restored to its original amplitude. A certain technic is involved during PCM to improve S/N ratio, to have higher resolution, etc. A signal coming from Envelope Generator into (+) REF pin gives right tone contour to a continual PCM waveforms being decoded and converted to an analog sound.

今 BASS DRUM1(BD-1)が選択された状態で、リズムが走ったとすると、IC30に$\overline{XST0}$(チャンネル0スタート)と$\overline{XSTA}$(XST0-7イネーブル)が加わり、カウンタCH0は0000Hにリセットされた後XCK0に加えられて来るクロックBをカウントして行きます。この13ビット・アドレスカウンタのカウント値は40μs毎にアドレス・セレクタによりADR0-ADRC端子に出力されて行きます。(次にもう一度$\overline{XST0}$が加わらない場合、カウンタは最大値1FFFHに達するとストップしたままとなります。)

サウンド・データの読み出し

256KビットROM IC34,IC35のメモリ・ロケーションにアクセスするには、15ビットのアドレスが必要です。残りのMSB2ビットにはIC30のA,Bクロックが当てられます。クロックCは、どちらのROMにアクセスするかを選ぶチップセレクトです。一方LSB ADR0は、音源によってはROMアドレスとして使用されません。例えば、BD-1とBD-2は同じROMのメモリ・エリアを共有しており、BD-1には偶数のアドレスがBD-2には奇数アドレスが割当てられています。(表1参照)。この為、BD-1の場合、ROMのA0には常に"0"がIC32,IC33を通じて加えられます(BD-2の場合は"1")。

ROMから読み出されたサウンド・データは、IC37(ラダー・ネットワーク内蔵)でアナログ電圧に変換されリズム音波形の一部分(サンプリング波形)を再現しますが、振巾値は原音の値とは必ずしも一致しません。これはPCMの過程において S/N比や分解能向上の処理が合まれている為です。再生音のエンベロープは、IC37の(+)REFに流れ込むENV GENからの信号によって左右されます。

TR-727 Sound Data ROM

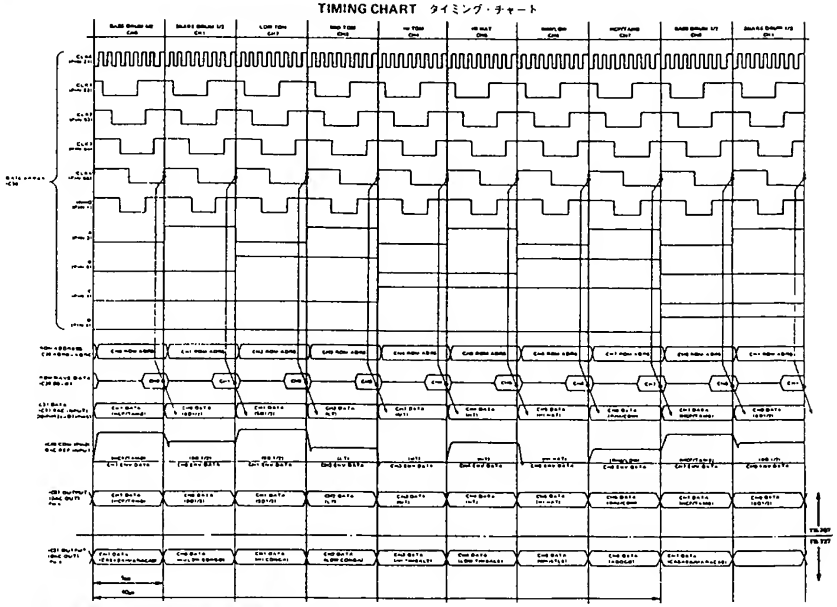
IC NO.	ROM	CE	CS	VOICE	MEMORY
IC34	HN61256PC71 (15179694)	H	L	HI BONGO	2N ADRS 4k byte
				LOW BONGO	2N + 1 ADRS 4k byte
				MUTE HI CONGA	2N ADRS 4k byte
				OPEN HI CONGA	2N + 1 ADRS 4k byte
				LOW CONGA	8k byte
				HI TIMBALE	8k byte
IC35	HN61256PC80 (15179695)	H	H	LOW TIMBALE	8k byte
				WHISTLE	8k byte
				MT AGOGO	2N ADRS 4k byte
				LOW AGOGO	2N + 1 ADRS 4k byte
				CABASA	2N ADRS 4k byte
				MARACAS	2N + 1 ADRS 4k byte

TR-707 Sound Data ROM

IC NO.	ROM	CE	CS	VOICE	MEMORY
IC34	HN61256PC71 (15179661)	H	L	BASS DRUM 1	2N ADRS 4k byte
				BASS DRUM 2	2N + 1 ADRS 4k byte
				SNARE DRUM 1	2N ADRS 4k byte
				SNARE DRUM 2	2N + 1 ADRS 4k byte
				LOW TOM	8k byte
				MID TOM	8k byte
IC35	HN61256PL72 (15179662)	H	H	HI TOM	8k byte
				HI HAT	8k byte
				RIM SHOT	2N ADRS 4k byte
				COW BELL	2N + 1 ADRS 4k byte
				HAND CLAP	2N ADRS 4k byte
				TAMBOURINE	2N + 1 ADRS 4k byte

Table 1 表1

TIMING CHART タイミング・チャート



ENVELOPE GENERATOR

Data coming to latch IC31 is a combination of LEVEL and DYNAMICS (ACCENT). The value of LEVEL is always constant regardless of voice selected, while DYNAMICS varies with MIDI Velocity or ACCENT amount setting.

Although LEVEL/DYNAMICS is connected to all 8 ENV GENERATORs it is allowed to enter only the transistor whose base-emitter junction, for example Q26, is being forward biased by a TRIG from latch IC27 or IC28 at XSTA rate. Q26 output is then connected by IC40 to (+) REF pin of IC37 every 40μs with its level decaying according to C53×R59 time constant as the successive BD-1 data are converted to analog voltages, giving a bass drum contour to the voice.

The DAC output is boosted at Q41 and Q42 conjunction and is channeled into the S/H which is designated by A B C code placed at IC41 select pins.

As can be seen from the timing chart, the timing of enveloping and D/A converting lag one slit behind the memory addressing. That is, BD-1 sound read from ROM with channel No. ABC=000 becomes an audible sound when channel No. is represented by ABC=100. This is because the data accessed on a positive going CLK4 with ABC=000 is latched into IC36 on the next CLK4 with ABC=100. Consequently, TRIG data to ICs 27 and 28, and LEVEL/DYNAMICS data to IC31 are made to delay one CLK4 cycle to keep pace with D/A conversion at IC37

エンベロープ・アクセント

XSTA(SXT0-7イネーブル)はIC30のアドレスカウンタに加えられると同時に、ラッチIC27,28のCKにも加えられ、BD-1が選択されている時には、ENV GENのQ26がTRIGパルスによって導通し、LEVELとDYNAMICS(ACCENT)の混合された電圧がC53に充電されます。なお、LEVELの値はどの音源の場合でも常に一定です。また、LEVEL/DYNAMICS CVは8本全てのトランジスタに印加されますが、TRIGパルスが現在加わっているトランジスタにのみに流入します。Q26の出力はIC39dを通り、IC40により時分割でD/AコンバータのREF端子へ送られて行きますが、振巾はC53×R96の時定数に応じて減衰して行きます。時定数はBDのサウンド・データ全部がROMから読み出される時間より長くなる様に設定されています。

注 IC30のアドレス・カウンタのチャンネル番号とIC40/41のチャンネル番号が異なっています。これはROMのサウンドデータが、アクセスされた時よりCLK4の1サイクル分遅れてIC36にラッチされD/A変換される為です。したがってTRIGおよびLEVEL/DYNAMICSデータもその分遅れて出力されます。

HI HAT

Output from Q35 has no distinction between closed hi hat and open hi hat and is given a particular waveshape (decay) at VCA Q22 and IC42 as OPEN/CLOSED select signal is applied on the base of Q21.

Hi Hat に対しては、もう一度エンベロープ回路(VCA－IC42a，Q32)が追加されており、クローズかオープンかによりディケイタイムを切替えています。

SINGLE SOUND PROCESSING

Each of CYMBAL voices (RIDE and CRASH) has dedicated sound ROM, address counter, D/A converter and envelope generator. The difference from Multiplex processing in circuit configuration is that envelope control is accomplished after the wave data becomes analog form. LEVEL/DYNAMICS (ACCENT CV) rounted to Q18 emitter (CRASH) is charged into envelope capacitor C50 on a TRIG, giving a contour to CRASH sound passing through Q14.

シングル音源

RIDE CYMBALおよびCRASH CYMBALは、それぞれ専用のアドレス・カウンタ，ROMおよびD/Aコンバータを持っていますが動作原理はマルチ音源の場合と変りません。ただし、エンベロープがD/A変換後VCAに加えられる点が違います。

TR-707 Sound ROM

IC NO.	ROM	CE	CS	VOICE	MEMORY
IC19	HN61256PC73 (15179663)	H	L	CRASH CYMBAL	32k byte
IC22	HN61256PC74 (15179664)	H	L	RIDE CYMBAL	32k byte

TR-727 Sound ROM

IC NO.	ROM	CE	CS	VOICE	MEMORY
IC19	HN61256PC81 (15179696)	H	L	QUIJADA	32k byte
IC22	HN61256PC82 (15179697)	H	L	STAR CHIME	32k byte

Table 2　表2

TESTING AND ADJUSTING

The built-in test program executes the following test and adjusting routines while in Test Mode.

RUNNING TEST PROGRAM

While holding down CLEAR and INSTRUMENT, switch the power ON. The unit is now in the test mode and the test program initiates test routines with TEST 1.

TEST 1. LED SEQUENTIAL LIGHTING

Upon entering test mode the program lights up LEDs, starting with MAIN KEY 1 through SCALE INDICATOR, PATTERN GROUP and CARTRIDGE (red and green alternately) and repeats.
Leave the LEDs lighting and go to TEST 2.

TEST 2. ALL LEDs AND LCD DOTS LIGHTING

Press ENTER and verify lighting of all LEDs and LCD dots.
Leave them lit and go to TEST 3.

TEST 3. SWITCHES AND ACCENT AMOUNT READING

Press ENTER. All LCD display will be cleared OFF. Referring to the illustration below, push numbered buttons 1–32 one by one and check for the lighting of corresponding dot on either Bass Drum (BonGo) or Snare Drum (Hi Conga) row on the display window.
Slide up or down ACCENT and verify that TEMPO MEASURE window reads 1 and 16 at the extremities of travel.

テストおよび調整

TR－707，TR－727 には回路機能チエックおよび調整用のプログラムが内蔵されています。このプログラムを走らせるにはテストモードに入る必要があります。

テストモード

CLEARと INSTRUMENT ボタンを同時に押しながら電源をオンするとテストモードとなり、テスト1が自動的に実行されます。

テスト1 LED順次点灯

テストモードに入ると、メインキーの1から順次LEDが点灯して行きます。CARTRIDGEのLEDは赤と緑が交互に点灯します。
LEDの点灯はくり返されますが、そのままの状態でテスト2へ進んで下さい。

テスト2 LEDおよびLCD全点灯

ENTERを押します。全てのLEDおよびLCD 上の全ドットが点灯する筈です。
そのままの状態でテスト3へ進んで下さい。

テスト3 スイッチおよびアクセントレベル読込み

ENTERを押すとLCDのドットが消えます。パネル上のスイッチを押すと、右図に示す様に、対応した番号のドットがLCDの上に表示されます。

If not verified, go to ACCENT AMOUNT ADJUSTMENT below without exiting the test mode.

When all tests are satisfactory, turned the power off and on again to return to the normal operation mode (if necessary).

ACCENT AMOUNT ADJUSTMENT

This test must be carried out in the test mode and follow the tests above.

1. Set ACCENT at MIN and adjust TM2 of VOICING board for a transition point of "1" to/from "2" of TEMPO MEASURE display reading.
2. Set ACCENT at MAX and adjust TM3 for a transition point of "15" to/from "16" of TEMPO MEASURE display reading.

The unit will remain in the test mode until the power is turned OFF.

TEMPO CLOCK RATE ADJUSTMENT

This adjustment must be done in the normal operation mode.

1. Set TEMPO at FAST and adjust TM1 of VOICING board for 250 reading on TEMPO MEASURE window.

次に、アクセント（ＡＣ）つまみを上下させるとＬＣＤのＴＥＭＰＯ/ＭＥＡＳＵＲＥ 部に数字が表示されます。MINの位置で"１"、ＭＡＸで"１６" とならない場合は、次のアクセントレベル調整へ進んで下さい。
調整が不要で、通常のモードに戻るには一旦電源をオフにして下さい。

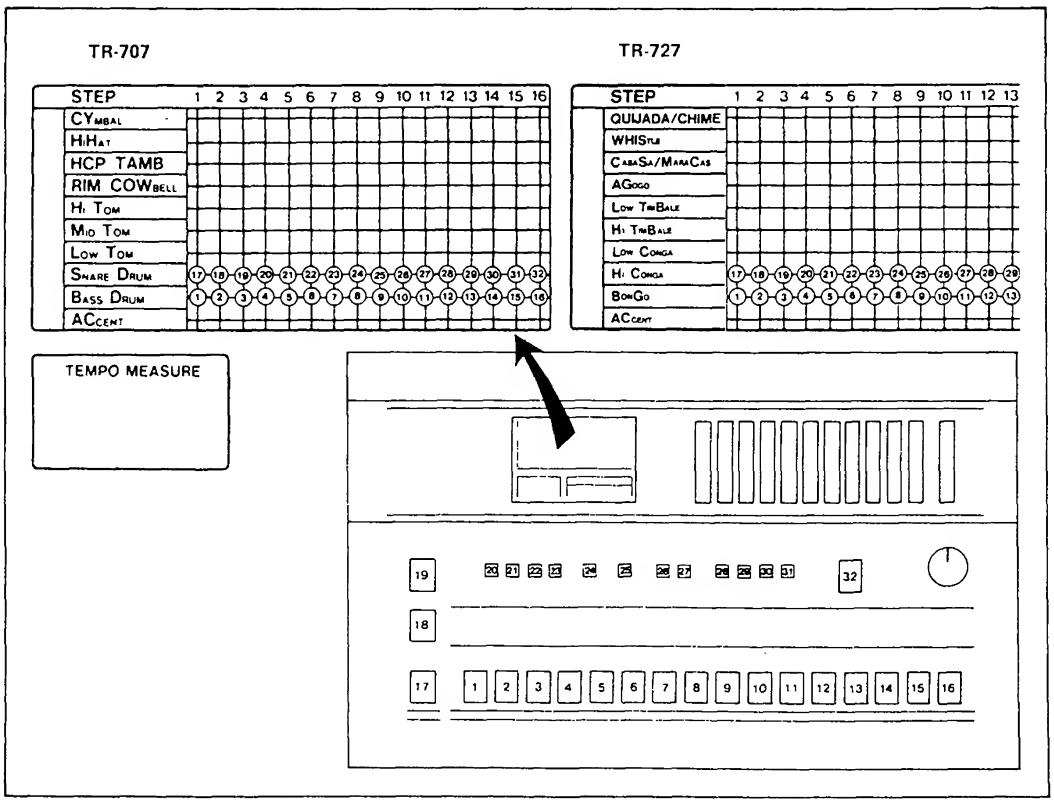
アクセントレベル調整

本調整はテストモードで行ないます。上記のテストの後で行なって下さい。

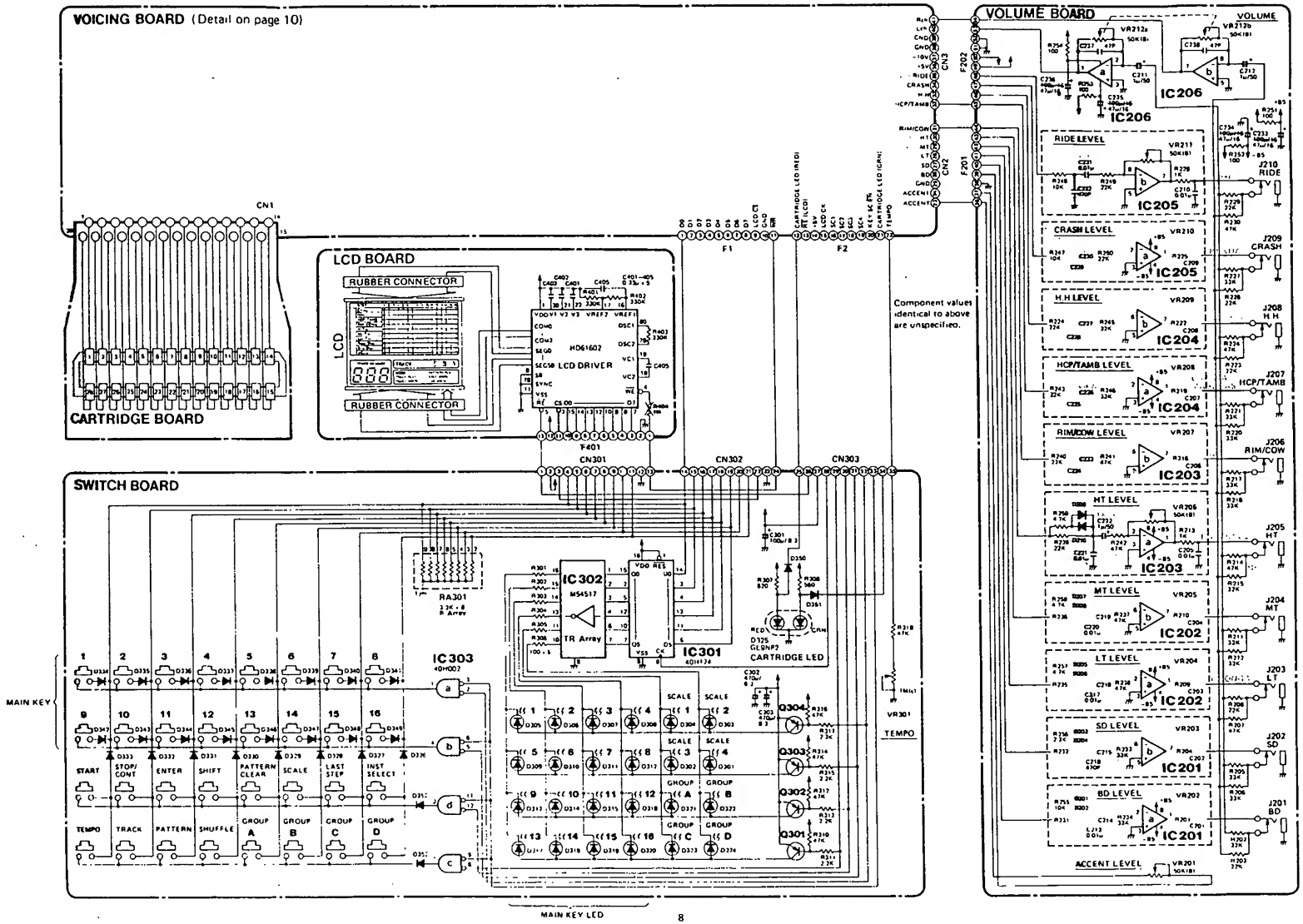
1. アクセント（ＡＣ）をＭＩＮにセットし、ＴＭ２（ボイシング基板）でＴＥＭＰＯ/ＭＥＡＳＵＲＥ の表示が"１"か"２"になる臨界点に調整します。
2. ＡＣをＭＡＸにセットし、ＴＭ３で表示が"１５"か"１６"になる臨界点に調整します。

テンポ調整

本調整は通常のモードで行ないます。テストモードになっている場合は、一度電源をオフにして下さい。
ＴＥＭＰＯをＦＡＳＴにセットし、ＴＭ１（ボイシング基板）でＴＥＭＰＯ/ＭＥＡＳＵＲＥの表示が２５０になる様調整します。



TR-707/TR-727 GENERAL CIRCUIT DIAGRAM



VOLUME BOARD

TR-707 7313605000 (pcb 2291098002)

TR-727 7313805000 (pcb 2292019000)

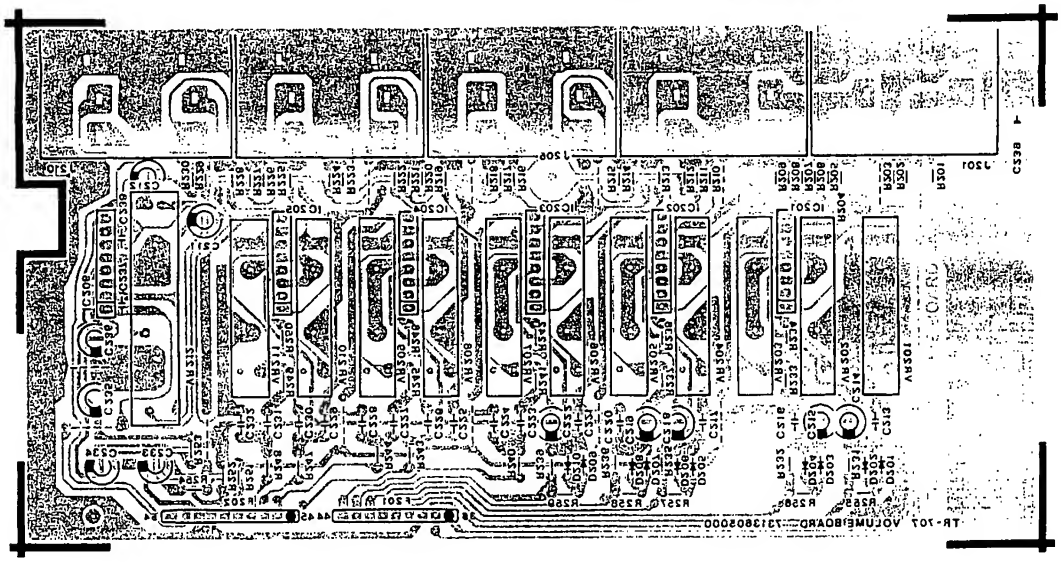
View from foil side

BELOW PCB LAYOUT For TR-707

TR-727's identical to TR-707's except for those represented in red in the circuit diagram left.

下の基板図はTR-707用です。

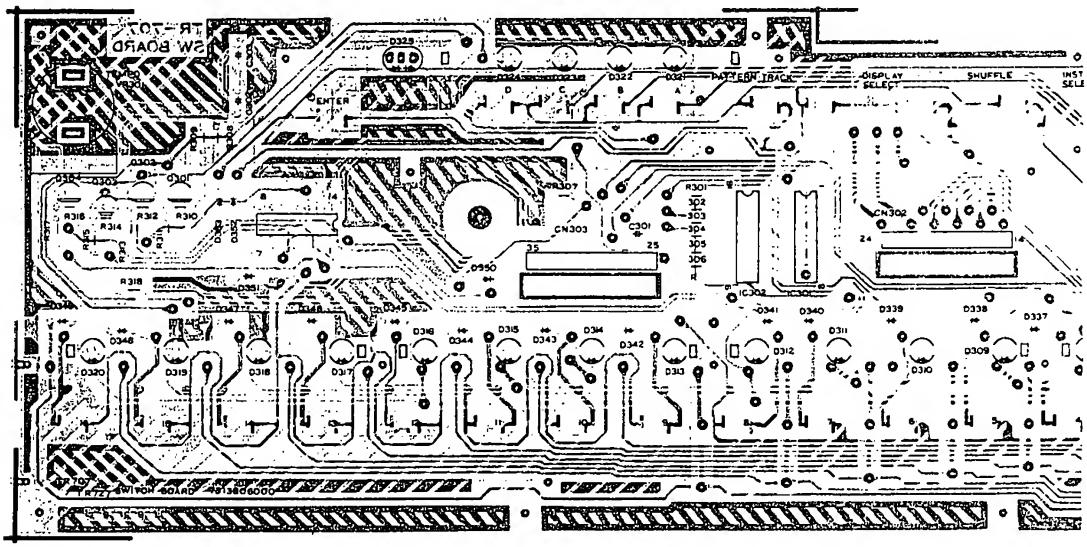
TR-727の場合は回路図の赤線表示に従って相違点を確認して下さい。



SWITCH BOARD

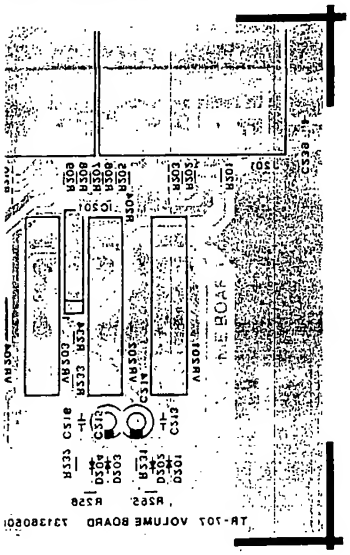
7313606000 (pcb 2291097903)

View from foil side



UT For TR-707

R-707's except for those represented in red diagram left

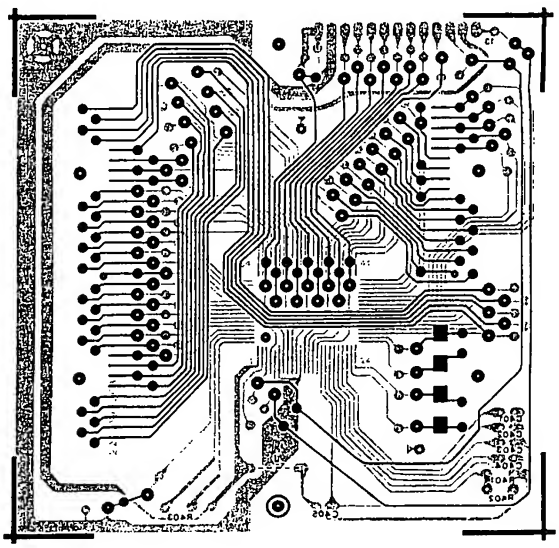


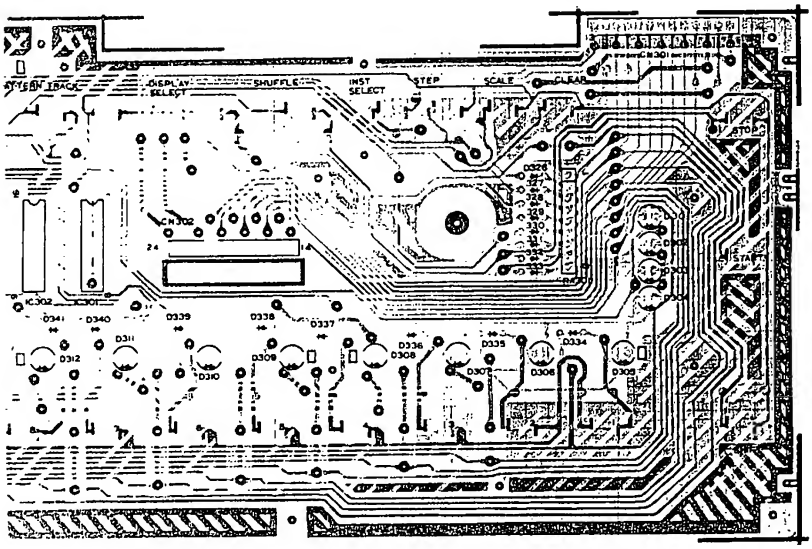
LCD BOARD

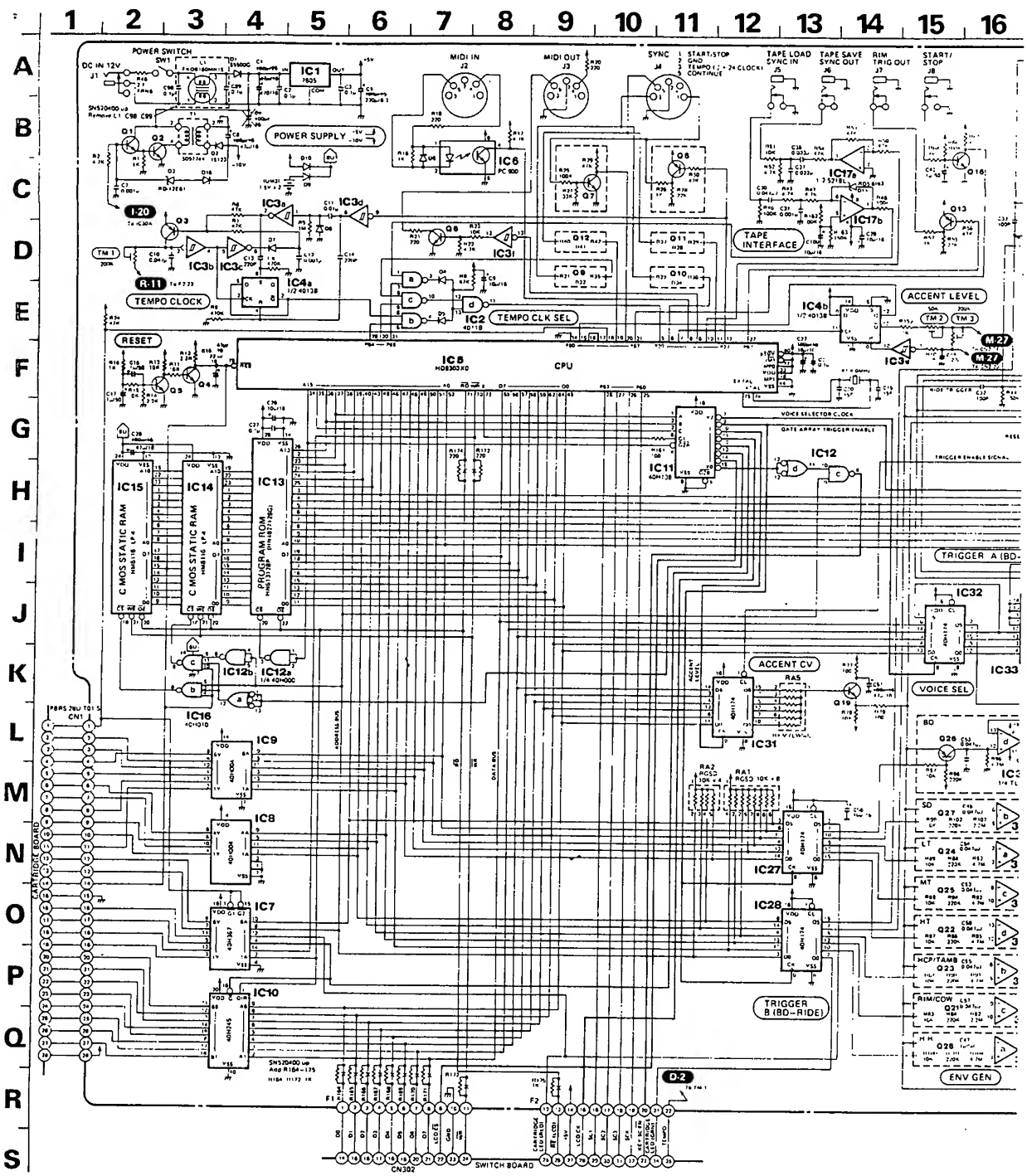
7313607000

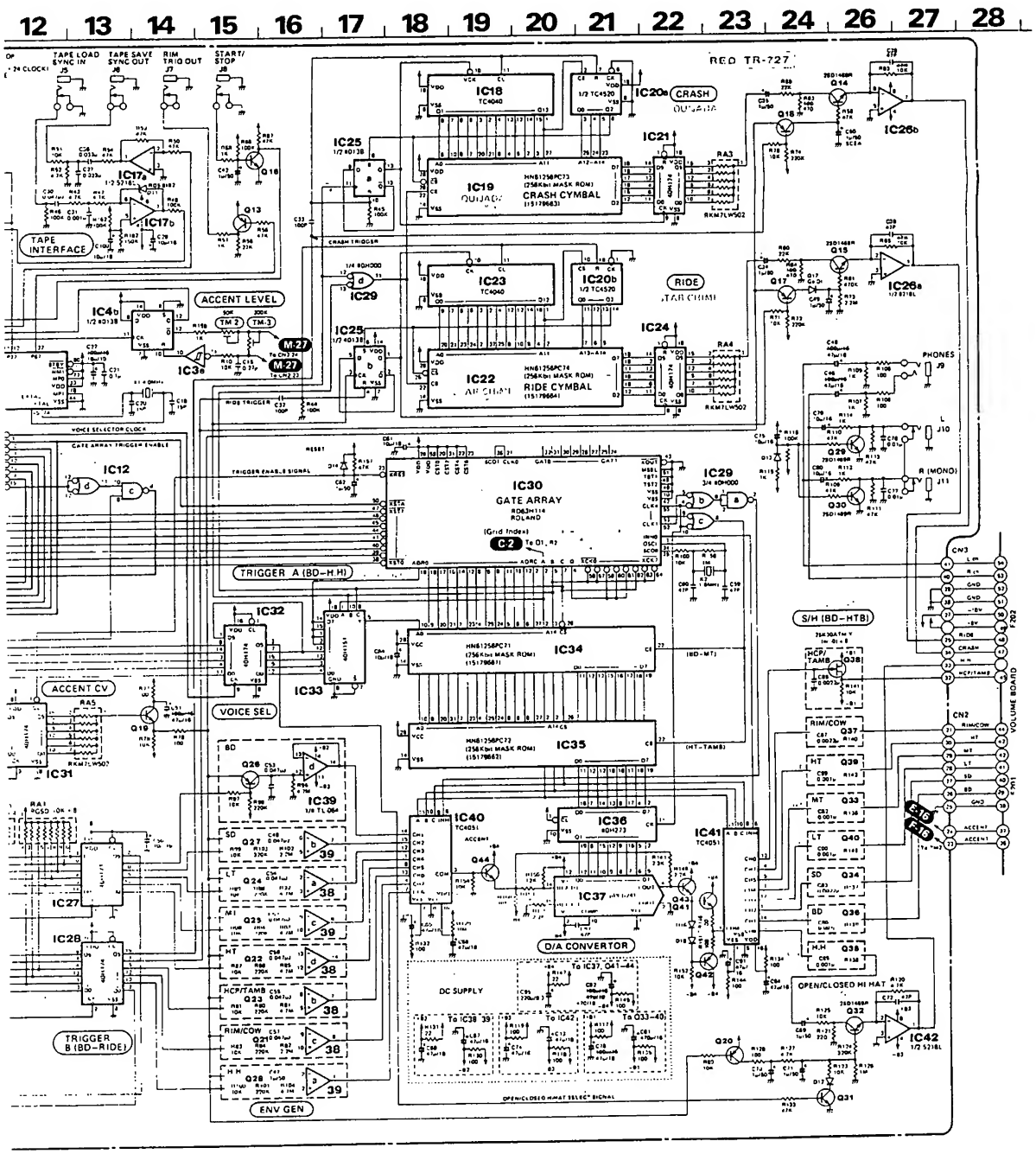
(pcb 2291098203)

View from foil side






POWER SWITCH
DC IN 12V
IC1
MIDI IN
MIDI OUT
SYNC
TAPE LOAD SYNC IN
TAPE SAVE SYNC OUT
RIM TRIG OUT
START/ STOP
POWER SUPPLY
IC6
TAPE INTERFACE
IC17a
IC17b
TEMPO CLOCK
IC3a
IC3b
IC3c
IC3d
IC3f
IC4a
IC4b
IC2
TEMPO CLK SEL
ACCENT LEVEL
RESET
IC5
CPU
IC15
IC14
IC13
C MOS STATIC RAM
PROGRAM ROM
IC12
IC11
IC12a
IC12b
IC16
IC9
IC8
IC7
IC10
IC32
IC33
ACCENT CV
VOICE SEL
IC31
IC27
IC28
TRIGGER B (BD-RIDE)
ENV GEN
CARTRIDGE BOARD
CN1
SWITCH BOARD
CN302

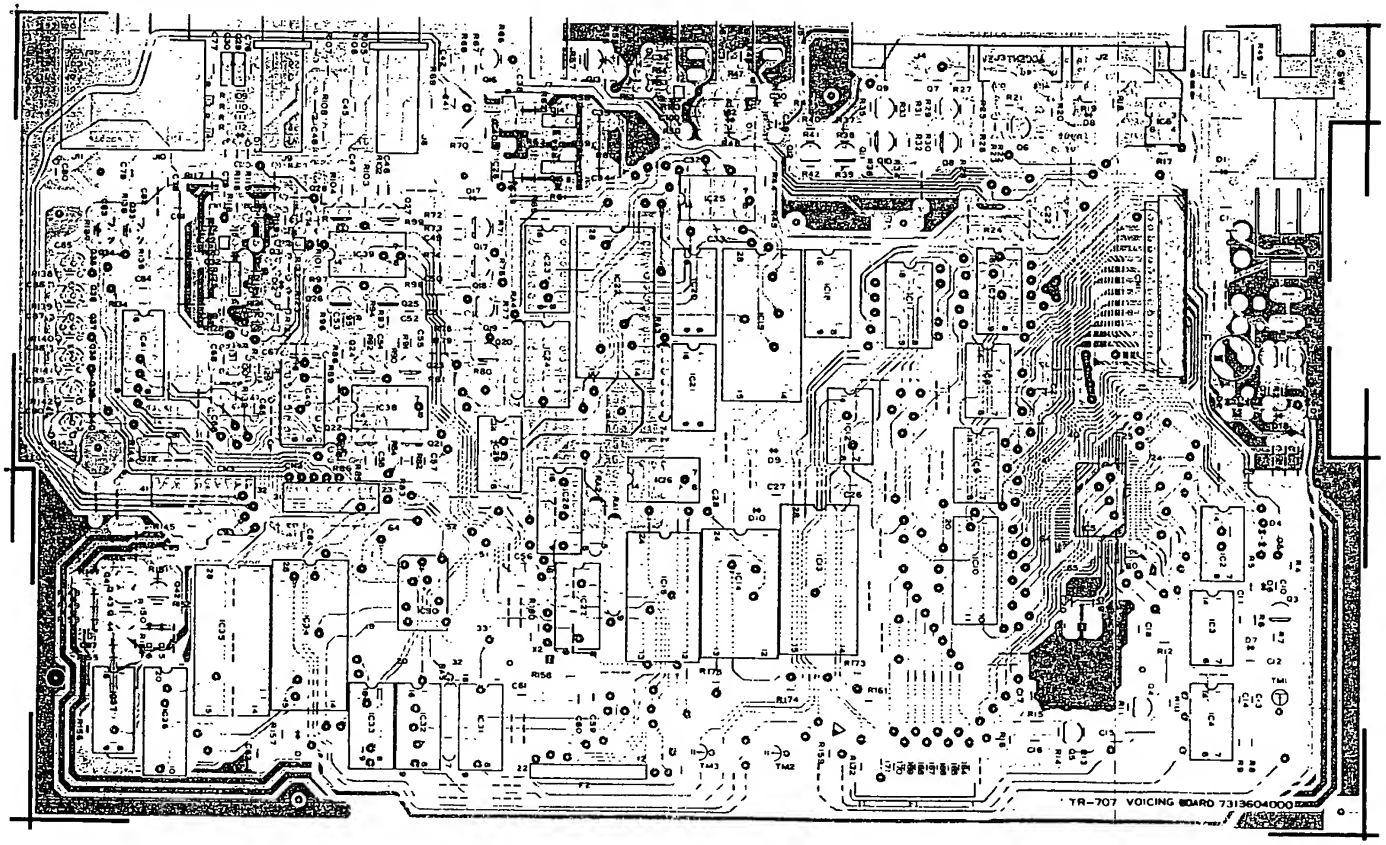

12 13 14 15 16 17 18 19 20 21 22 23 24 26 27 28
REQ TR-727
TAPE LOAD SYNC IN
TAPE SAVE SYNC OUT
RIM TRIG OUT
START/ STOP
TAPE INTERFACE
ACCENT LEVEL
IC30 GATE ARRAY
TRIGGER A (BD–H.H)
TRIGGER B (BD–RIDE)
ACCENT CV
VOICE SEL
ENV GEN
D/A CONVERTER
DC SUPPLY
CRASH
RIDE
S/H (BD–HTB)
PHONES
R (MONO)
VOLUME BOARD
OPEN/CLOSED HI HAT

VOICING BOARD

TR-707 7313604000 (pcb 2291098102)
TR-727 7313804000 (pcb 2292018900)

BELOW PCB LAYOUT For TR-707
TR-727's: identical to TR-707's except for those represented in red in the circuit diagram left.

下の基板図はTR-707用です。
TR-727の場合は回路図の赤線表示に従って相違点を確認して下さい。

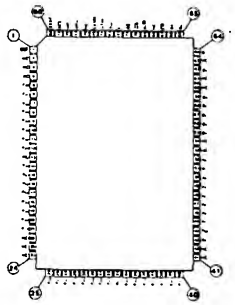


View from foil side

IC DATA

CPU HD6303X

Pin Configuration
(Top View)

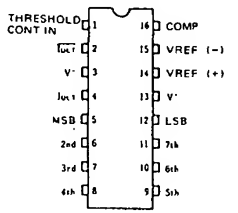


Port Assignment

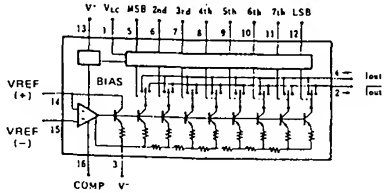
PIN NO.	PORT NAME	DESCRIPTION
1	NMI	Unused, pulled up +5V
2-4	NC	Unused, open
5	P20	input, TEMPO CLOCK
6	P21	output, TEMPO CLOCK (DIN)
7	P22	output, ACCENT LEVEL input trigger for internal ADC
8	P23	input, MIDI IN
9	P24	output, MIDI OUT
10	P25	output, TAPE SYNC
11	P26	output, CONT START (DIN)
12	P27	output, START/STOP (DIN)
13	NC	unused, open
14	P50	IRQ1 unused, pulled down
15	P51	IRQ2 input, ACCENT LEVEL
16	P52	MR unused, pulled up +5V
17	P53	HALT unused, pulled up +5V
18	P54	RAM cartridge control
19	P55	input, CONT START (DIN IN)
20	P56	input, START/STOP (DIN IN)
21	P57	input, START/STOP from remote control
22-24	NC	unused, open
25-28	P60-P63	output, scanning signal to LED and KEY
29	P64	output, internal TEMPO CLOCK
30	P65	output, DIN SYNC TEMPO CLOCK
31	P66	output, TAPE SYNC TEMPO CLOCK
32	P67	output, Trigger (RIM SHOT:TR-707)(HI AGOGO:TR-727)
33	Vcc	input, +5V power supply
34-40	A15-A9	output, address A15---A19
41-42	NC	unused, open
43	A8	output, address A8
44	Vss	GND
45-52	A7-A0	output, address A7---A0
53-54	NC	unused, open
55-59	D7-D3	data bus D7---D3
60-61	NC	unused, open
62	D2	data bus D2
63	NC	unused, open
64-65	D1-D0	data bus D1---D0
66	RA	output, unused
67	LIR	output,unused
68	NC	unused, open
69	R/W	output
70	WR	output
71	RD	output
72	E	output, system clock 1MHz
73	Vss	GND
74	XTAL	terminal, Xtal
75	EXTAL	terminal, Xtal or external system clock in
76	NC	unused, open
77	MPO	input, MCU mode setting pulled up +5V
78	MPI	input, MCU mode setting pulled down GND
79	RES	input, MCU reset (active low)
80	STBY	unused, pulled up +5V (active low)

μPC624C

Pin Configuration
(Top View)

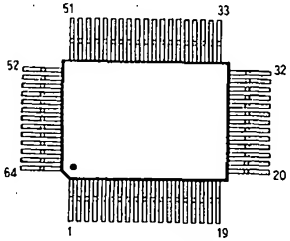


Block Diagram



GATE ARRAY RD63H114

Pin Configuration
(Top View)



PIN	name	PIN	name	PIN	name
1	INHO	23	CST6	45	XST5
2	ADRC	24	GATE7	46	XST6
3	A	25	GATE6	47	XST7
4	D	26	VDD	48	TST1
5	B	27	GATE5	49	TST2
6	ADR7	28	GATE4	50	XSTA
7	C	29	GATE3	51	MSEL
8	ADR6	30	GATE2	52	CLK1
9	ADR8	31	GATE1	53	CLK2
10	VSS	32	GATE0	54	CLK3
11	ADR9	33	XRES	55	CLK4
12	ADR5	34	OSCI	56	XCK0
13	ADR8	35	SCO0	57	XCK1
14	ADR4	36	SCO1	58	VDD
15	ADR3	37	CLK0	59	XCK2
16	ADRA	38	XST0	60	XCK3
17	ADR2	39	XST1	61	XCK4
18	ADR1	40	XST2	62	XCK5
19	ADR0	41	XST3	63	XCK6
20	CST0	42	VSS	64	XCK7
21	CST2	43	XOUT		
22	CST4	44	XST4		

Multiple Address Counters

DESIGNATION	PIN		DESCRIPTION		I/O
CST	0	20	pulled up (+5V) / continue start	counter 0	I
	2	21		counter 2	I
	4	22		counter 4	I
	6	23		counter 6	I
XST	A	50	XST0-XST7 enable, active low		I
	0	38	counter start, active low	counter 0	I
	1	39		counter 1	I
	2	40		counter 2	I
	3	41		counter 3	I
	4	44		counter 4	I
	5	45		counter 5	I
	6	46		counter 6	I
	7	47		counter 7	I
XCK	0	56	counter clock input	counter 0	I
	1	57		counter 1	I
	2	59		counter 2	I
	3	60		counter 3	I
	4	61		counter 4	I
	5	62		counter 5	I
	6	63		counter 6	I
	7	64		counter 7	I
XOUT		43	address(ADR0-ADRC) out enable, active low; high-HI z		I
ADR	0	19	ROM ADDRESS		O
	1	18			O
	2	17			O
	3	15			O
	4	14			O
	5	12			O
	6	8			O
	7	6			O
	8	9			O
	9	11			O
	A	16			O
	B	13			O
	C	2			O
A		3	MUX,DMUX channel select	100kHz	O
B		5		50kHz	O
C		7	system clock for 8 counters	25kHz	O
D		4		12.5kHz	O
INHO		1	DMUX inhibit		O
OSCI		34	internal clock generator		I
SCCO		35		master clock out 1.6MHz	O
SCOI		36			O
CLK	0	37		system clock in 1.6MHz	I
	1	52	system clock 100kHz		O
	2	53		MUX inhibit	O
	3	54	nc / latch clock — ROM chip enable		O
	4	55			O
XRES		33	reset pulse, active low		I
MSEL		51	counter 12/13 bit select	pulled down	I
TST1		48	IC test	pulled down	I
TST2		49			I
Vss		10	GND		
Vss		42			
VDD		26	power supply +5V		
CAT	0	32	counter gate output low=counter running		O
	1	31			O
	2	30			O
	3	30			O
	4	29			O
	5	28			O
	6	25			O
	7	24			O

TR-707/TR-727 MIDI IMPLEMENTATION

1. TRANSMITTED DATA

Status	Second	Third	Description
1001 nnnn	0kkk kkkk	0000 0000	Note OFF *1 kkkkkkk = 35-51 54, 56, *5 60-74 (TR 727 only)
1001 nnnn	0kkk kkkk	0vvv vvvv	Note ON *1 kkkkkkk = 35-51 54 56 *5 60-74 (TR 727 only) vvvvvvv = 40 - 124
1111 0010	0sss ssss	0sss ssss	Song Position Pointer *2 [illegible] Least significant [illegible] Most significant
1111 0011	0sss ssss		Song Select *3 sssssss = 0 - 3 (track #)
1111 1000			Timing Clock *4
1111 1010			Start
1111 1011			Continue
1111 1100			Stop
1111 0000	0100 0001 1111 0111 (EOX)	0nnn nnnn	0nnn nnnn Sequence Data (Exclusive message)

Notes: *1 Transmitted channel # can be changed to 1 - 16 from the front panel. When the power is applied, the latest channel # set prior to the last power OFF remains unchanged.
*2 When the measure number is set
*3 When the track # is set

track #	sssssss
1	0
2	1
3	2
4	3

*4

Tempo Mode	Synchronized with
Internal	internal tempo clock
MIDI mode	received timing clock
DIN mode	positive edge of the DIN clock

*5 Note numbers are assigned as follows.

Setting A. Normal
Setting B. When the "MIDI CH" then "LAST STEP" buttons are pressed while the "SHIFT" button is being pressed

TR-727

Key Name	Setting A kkkkkkk	Setting B kkkkkkk
Hi Bongo	60	35
Low Bongo	61	36
Mute Hi Conga	62	38
Open Hi Conga	63	40
Low Conga	64	41
Hi Timbale	65	45
Low Timbale	66	48
Hi Agogo	67	37
Low Agogo	68	56
Cabasa	69	39
Maracas	70	54
Short Whistle	71	42
Long Whistle	72	46
Quijada	73	49
Star Chime	74	51

TR-707

Key Name	Setting A kkkkkkk	Setting B kkkkkkk
Bass drum 1	35	36
Bass drum 2	36	31
Rim shot	37	43
Snare drum 1	38	38
Hand clap	39	45
Snare drum 2	40	39
Low tom	41	40
Closed Hi-hat	42	47
Mid tom	45	41
Open Hi-hat	46	44
High tom	48	42
Crash cymbal	49	49
Ride cymbal	51	50
Tambourine	54	46
Cowbell	56	[illegible]

2. RECOGNIZED RECEIVE DATA

Status	Second	Third	Description
1001 nnnn	0kkk kkkk	0vvv vvvv	Note ON *1 kkkkkkk = 60-74 (TR 727) *2 = 35-51 54, 56 (TR-707) vvvvvvv ≠ 0 *2
1011 nnnn 1011 nnnn	0111 1100 0111 1101	0000 0000 0000 0000	MODE [illegible] OMNI ON
1111 0010	0sss ssss	0sss ssss	Song Position Pointer *3 [illegible] Least significant [illegible] Most significant
1111 0011	0sss ssss		Song Select *3 sssssss = track #
1111 1000			Timing Clock *4
1111 1010			Start *4
1111 1011			Continue *4
1111 1100			Stop *4
1111 0000	0100 0001 1111 0111 (EOX)	0100 0010	0nnn nnnn Sequence Data (Exclusive message)

Notes: *1 Received channel # can be changed to 1 - 16 from the front panel. When the power is applied, the latest channel # set prior to the last power OFF remains unchanged.

*2 Recognized while in the Track Play mode.
Any of the key numbers (35 - 98) may be assigned to each instrument from panel operation, and will be kept assigned even after the power is turned OFF.
Received note numbers are assigned at the factory as follows.

TR-727

kkkkkkk	Instrument
60	Hi Bongo
61	Low Bongo
62	Mute Hi Conga
63	Open Hi Conga
64	Low Conga
65	Hi Timbale
66	Low Timbale
67	Hi Agogo
68	Low Agogo
69	Cabasa
70	Maracas
71	Short Whistle
72	Long Whistle
73	Quijada
74	Star Chime

TR-707

kkkkkkk	Instrument
35	Bass Drum 1
36	Bass Drum 2
37	Rim Shot
38	Snare Drum 1
39	Hand Clap
40	Snare Drum 2
41, 43	Low Tom
42, 44	Closed Hi-Hat
45, 47	Mid Tom
46	Open Hi-Hat
48, 50	High Tom
49	Crash Cymbal
51	Ride Cymbal
54	Tambourine
56	Cowbell

All the note OFF messages are ignored.

*3 Recognized while the unit STOPS in the Track Play mode
*4 When the SYNC mode is at MIDI

While in the Tape Interface mode, all MIDI messages are ignored.

3. HANDSHAKING COMMUNICATION

3.1 Message Type

3.1.1 Want to send a file (WSF)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0101 0000	Operation code
d 1111 0111	End of System Exclusive

3.1.2 Request a file (RQF)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0101 0001	Operation code
d 1111 0111	End of System Exclusive

3.1.3 Data (DAT)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0101 0010	Operation code
d 0000 0010	Format type
e 0100 nnnn	Block # 10 - [illegible]
f 0000 [illegible]	
0000 [illegible]	
	512 data bytes (256 bytes of [illegible])
0000 [illegible]	
0000 [illegible]	
g 0sss ssss	Check sum (for preceding 512 data bytes)
h 1111 0111	End of System Exclusive

Note:
Summed value of the all bytes in data and the check sum must be 0 (7 bits).

3.1.4 Acknowledge (PAS)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0101 0011	Operation code
d 1111 0111	End of System Exclusive

3.1.5 Continue (CNT)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0101 0100	Operation code
d 1111 0111	End of System Exclusive

3.1.6 End of file (EOF)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0101 0101	Operation code
d 1111 0111	End of System Exclusive

3.1.7 Communication error (ERR)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0111 0001	Operation code
d 1111 0111	End of System Exclusive

3.1.8 Rejection (RJC)

Byte	Description
a 1111 0000	Exclusive status
b 0100 0001	Roland ID #
c 0111 0000	Operation code
d 1111 0111	End of System Exclusive

3.2 Sequence of Communication

3.2.1 When the RQF is recognized

a	RQF	Request a File	(received)
b	DAT	Data	(transmitted)
	CNT	Continue	(transmitted)
	PAS	Acknowledge (14 times)	(received)
c	DAT	Data	(transmitted)
	EOF	End of File	(transmitted)
	PAS	Acknowledge	(received)

3.2.2 When the WSF is recognized

a	WSF	Want to Send a File	(received)
b	RQF	Request a File	(transmitted)
c	DAT	Data	(received)
	CNT	Continue	(received)
	PAS	Acknowledge (14 times)	(transmitted)
d	DAT	Data	(received)
	EOF	End of File	(received)
	PAS	Acknowledge	(transmitted)

3.2.3 When the WSF is received with error

a	WSF	Want to Send a File	(received)
b	RJC	Rejection (The sequence will abort then return to normal operation.)	(transmitted)

3.2.4 When the EOF is received with error

a	RQF	Request a File	(received)
b	RJC	Rejection (The sequence will abort then return to normal operation.)	(transmitted)

3.2.5 When the ERR is recognized

DAT	Data	(transmitted)
CNT	Continue	(transmitted)
ERR	Communication error	(received)
DAT	Data (same block)	(transmitted)
CNT	Continue	(transmitted)

3.2.6 When DAT or others is received with errors

DAT	Data	(received)
ERR	Communication error	(transmitted)

The unit will expect to receive the previous DAT